Research Bulletin

Faculty of Resource Science and Technology
Volume 1/ February 2010 ISSN 1511-0788

Vertebrates of Borneo (photograph courtesy of Badiozaman Sulaiman)

Contents

Dean's Message

Prof Dr Shabdin Mohd Long

Happy New Year 2010!

Academic members of FRST achieved outstanding output in teaching, research, publication and also consultations. Faculty has a vibrant community of researchers who are involved in cutting-edge research that can benefit the nations. We should evaluate our strength and weaknesses in order to perform better in the year 2010. Throughout 2009 faculty members successfully obtained 11 research grants from various organizations with the total amount of RM 901,126, besides funding of research project through Memorandum of Agreement with various established agencies totaling to RM 1,218,078. Within the same year 46 on-going research projects were also actively carried out and significant finding have been reported. Academic members were also actively involved in 14 consultation project throughout 2009. The research finding has been published in various journal, proceeding and presentation at national and overseas conferences. A total of 120 papers have been published by FRST academic staff and out of that 65 papers were published in journals. The publications cover wide area of research but are generally classified into two niche area of faculty namely Molecular Biology & Biotechnology and Sustainable Resource Management & Utilization. Research collaboration with other national and international organization was also established in order to strengthen teaching- learning and research endeavours. Four research groups namely Biodiversity for Selected Ecosystems; Zoonoses and Emerging Infectious Diseases; Wise Use and Management of Tropical Peatlands and Sago Research has strengthens research and networking either locally or internationally.

Faculty has also successfully organized three conferences namely 2nd Junior Chemist Colloquium 2009; the 3rd Regional Conference on Natural Resources in the Tropics and 1st ASEAN Sago Symposium 2009 and a workshop on Harmful Algal Bloom and Biotoxin with the cooperation of National Oceanography Directoriate/MOSTI.

For the year 2010, the faculty is in the preparation to establish one or two Centre of Excellence which will promote research activity and collaboration with other established centres and also to focused research which will have significant impact on research, development and ation. Beside the research activity, several new academic programme based on current job requirement will also be established in gthen academic programme and to attract more student.

ope that all academic staff will show high commitment in order to achieve excellent performance in teaching, research, publication, and also services to the public. Hope that 2010 will be a very successful year to the faculty and UNIMAS.

ee to direct your enquiry to me at e-mail: lshabdin@frst.unimas.my or to the editorial members for further information.

ng.

A brief perspective on biodiversity conservation values from an Islamic viewpoint and their teaching in Malaysian educational institutions

Mohd Azlan Jayasilan
Department of Zoology

Meyer *et al.* (2000) identified 25 regions known as hotspots having the highest diversity and endemics, which contain the sole remaining habitat of 44% of the earth's plant species with 35% of its vertebrate species. These habitats face a high risk of eradication. Southeast Asia has the highest rate of deforestation compared to any other tropical region where approximately 75% of the original forest and 42% of its biodiversity is expected to be lost by 2100. The lack of local awareness, knowledge, interest and ownership in local conservation biology could be partially blamed for the losses. Without a 'mental revolution and cultural transformation' the future of conservation seems rather bleak in Malaysia. Sundaland, the third most threatened region in the world claims the highest Muslim population and is politically divided into Indonesia, Malaysia, Brunei and Singapore. Malaysia, one of the most economically developed Muslim countries in the world, has adopted various Islamic values.

In practice, this includes incorporation of Islamic ethics in governance, (*Penerapan nilai-nilai Islam*); Vision Islam, and in more recent year Islamic governance 'Islam Hadhari,' which emphasizes development, knowledge and plurality with ten principles, including "safeguarding the environment". An examination of records has shown that the Islamisation of law proceeded more methodically in Malaysia compared with elsewhere in Asia. Consequently, this would facilitate proposing policy and methods for practising sustainable development from an Islamic perspective. Islamic tradition and values could provide very effective and comprehensive answers and could be used as a tool to address the current state of the environment. One does not even have to be Muslim to benefit from such pedagogy. Islam stresses acquiring knowledge through hearing, seeing and reasoning. The Qur'an itself puts equal emphasis on natural science, psychology, history, geography, sociology, astronomy and other fields of knowledge.

Travel through the earth and see how God did originate creation (Qur'an, 029.020)

The Islamic foundation for an ecological moral principles rest firmly on the Al-Qur'an and Hadith. (Statements or actions of Prophet Muhammad P.B.U.H) where the notion on *Khalifah* (vicegerent) and *Amanah* (trusteeship), shows communal obligation to the environment. As nature belongs to God, it has been given to man merely as a trust and man's right to dominate over nature comes with conditions to protect it and use its resources sustainably. Privilege to utilise natural resources was given to humans on a guardianship basis, which basically means the right to use another person's property on the understanding that what is entrusted will not be damaged, destroyed or wasted. According to Islamic law the basic elements of nature such as land, water, fire, forest, and light were considered to be the common property of all, not just for human beings, but of all living things. The Qur'an and Hadith frequently calls to preserve equilibrium or balance, to be moderate in everything, and not to seriously disturb the order in nature.

The world is sweet and green (alluring) and verily God is going to install you as vicegerent in it in order to see how you act. (Sahih Muslim, *Book 036, Number 6606)*

With the current state of tropical rainforest, the approach of using Al-Qur'an and the Hadith as a conservational tool in Southeast Asia should be considered of paramount importance as Islam has been regarded as a way of life (*Ad-deen*) and will likely be accepted by many, including non-Muslims. Thus the compilation, accurate translation, and application of the Hadith and Qur'an from a conservation biology perspective should be greatly encouraged at University level synergizing with relevant courses and activities. For example, Islamic civilisation is a compulsory subject taught in most Malaysian universities. Injecting moral and ethical values and stewardship in conservation biology from an Islamic perspective would encourage the younger generation to view sustainable use and development from a broader viewpoint. This will promote young Malaysians to participate and engage on conservation and sustainable development without depending too much on foreign aid and recommendation which may result in legally binding contracts and requirements and may not be suitable to meet socio-political aspects of the local society. Muslims should aim to do it oneself without any dependency on foreign aid. Especially sine Islam is considered the best way of life (*deen*) and should be able to lead over other ideologies and worldviews.

In addition to this, the education system should encourage younger generations to seek and appreciate knowledge of the environment and its principles, in doing so passion on a selected subject could be achieved. Islam in ecology is certainly not a new concept but this is the first attempt to identify the core Islamic principles related to conservation biology; in the South East Asian context and how they could be applied in preventing or minimising environmental impacts and in enhancing positive impacts. Thus any ideas or suggestions to promote discussion and improve this article among scholars are welcomed. This is the first step to potentially to incorporate biodiversity conservation values from an Islamic perspective to develop a comprehensive strategic policy and action plan at national education level.

Acknowledgements

I am grateful to Prof Dr Shabdin Md. Long for his advice and encouragement. This short communication article has benefited greatly from the constructive comments of Dr. Daud Batchelor on earlier draft.

References

Qur'an

Hadith

Chong, T. (2006). *The emerging politics of Islam Hadhari.* In Swee-Hock, S. and Kesavapany, K.(Eds.): Malaysia: recent trends and challenges. Institute of Southeast Asian Studies, Singapore. Pp 26-46.

Izzi Dien, M.Y. (1999). *Islamic Ethics and the environment.* In Khalid, F. and O'Brien, J (Eds.), Islam and Ecology Cassell, London.

Khalid, F.M. and O'Brien, J. (1992). *Islam and Ecology.* In WWF (Ed.) *World Religions and Ecology Series*, WWF and Cassell, London.

Manzoor, S.P. (1998). *Environment and values: the Islamic perspective.* In Ziauddin Sardar (Ed.), The touch of Midas: Science, values and environment in Islam and the west. Pelanduk Publication, Kuala Lumpur.

Meyers, N., Mittermeier, R.A., Mittermeier, C.G., da Fonseca, G.A.B. and Kent, J. (2000). Biodiversity hotspots for conservation priorities. *Nature* 403: 853-858.

Sodhi, N.S., Koh, L.P., Brook, B.W. and Eng, P.K.L. (2004). Southeast Asian biodiversity: an impending disaster. *Trends in Ecology and Evolution* 19(12): 654-660.

Tabbarah, A.A. (1988). *The spirit of Islam: Doctrine and Teaching.* Dar El-Ilm Limalayin, Beirut, Lebanon.

The fun of learning: Zoology Department field work

Lim Chan Koon

Department of Zoology

Most university students would agree that field work is a fun part of their academic journey, and many would cherish this type of experience forever. The few days spent in the forests with their course mates, going through the hardships of collecting data from dawn until midnight or struggling to do damage control on the overcooked meals are full of fond memories. All second year undergraduates of the Department of Zoology eagerly await mid-semester break for a week-long field work, which is part of the requirement for the STH2103 Field and Laboratory Techniques course.

Last year, the site chosen was Gunung Sewa at Kampung Giam, Padawan. The limestone karst of Padawan areas had never been surveyed. It is located about 20km from UNIMAS and is a popular weekend recreation and picnic spots. Amazingly, located a mere 100 meters from the village and Giam waterfall is a treasure throve filled with rich flora and fauna. The habitat is a mixture of orchards, farm land, abandoned padi fields, old secondary forests as well as undisturbed limestone vegetation on Gunung Gewa. This place provides an excellence living laboratory for zoology students to get closer to nature and discover for themselves how animals adapted to changes to their environment.

View of Gunung Sewa from Kampung Giam

Sungai Sewa flowing into Sungai Sarawak Kiri

Fifty three students and staff of zoology department took part in the field work from 16 to 24 August 2008. The primary objective is to introduce the various field techniques to the students. This includes methods of capturing animals and species identification, taking the proper morphmetric measurements, taxidermy skill for preparing voucher specimens as well as procedure for collecting blood and tissue samples for molecular work. The secondary objective is to carry out a systematic inventory of the Padawan limestone areas in a series of field trips. Apart from gaining knowledge or learning new skills, the students get to know via first hand experience the importance of comradeship and spirit of team building when in the field. They helped each other to accomplish their assigned tasks.

Each group of students will lead the survey of one taxonomic group, with one member being rotated each day. This survey covered mammals, birds, amphibians and reptiles, insects, fish and aquatic invertebrate. For a short period of survey, the species diversity and composition is very impressive: mammals (27 species), birds (42 species), frogs (13 species), snakes (4 species), lizards (8 species), fish (9 species). For invertebrate, 65 species of butterflies, 5 species of crabs, 2 species of prawns, 2 species of snails, and 17 species of aquatic insects were recorded.

Conducting fish survey at Sungai Sewa

Lesser False Vampire (*Megaderma spasma*)

Although the study site appeared disturbed and the original forests had been altered, the rich biodiversity observed at Kampung Giam presents a pleasant finding. It showcases how the wildlife adapted to the changes of their ecosystem and habitat over times. It is not deniable that certain sensitive species or animal taxa such as large ungulates or hornbills are clearly missing. Nevertheless, some species have increased in numbers and exploited the alternatively food sources provided for by the orchards. In conclusion, this field work serves as a good platform to demonstrate the dynamism of species diversity and ecology. It also inculcates the young minds of the need to employ proper field techniques for future research. They also realised that they hard work and efforts are contributing to science and increase our understanding of the fauna diversity of Gunung Sewa, Kampung Giam. All in all, this field work had motivated them. They acquired new knowledge, new experiences, established new friendship and had an enjoyable week long field work albeit a tiring one. Most couldn't wait for the next field trip!

Group photo – Second Year Student (2008/09)

Amorphophallus diversity and conservation in Bornean Malaysia

Isa Ipor, Cheksum Supiah Tawan, Meekiong Kalu and Angeline Simon
Department of Plant Science and Environmental Ecology

Amorphophallus (Araceae: Thomsonieae) is commonly known as the corpse flower and Mayak (Iban) in Sarawak. It refers to the horrendous odor of decaying of salted fish flesh that commonly known as 'bunga bankai' by the Indonesian community. *Amorphophallus* has an estimated total number of 200 species and mainly found in the tropical of the old world — ranging from West Africa eastward into Polynesia. It is perennial and herbaceous foliage with an underground storage organ, which is usually a

tuber of various sizes and shapes that need to be sufficiently anchored to support the tall petiole or inflorescence. It is considered to be the largest unbranched inflorescence in the world as its ability to attain 6.5 to 10.75 foot height with *A. titanum* (Becc.) Becc., commonly known as giant titanarum with the most massive inflorescence , is among the largest of all *Amorphophallus* species after *A. decus-slivae* and *A. gigas* in term of plant height. The most fascinating part of this plant is the gigantic inflorescence that appeared from the ground surface with lack (or almost absent of leaf) of leaves.

Amorphophallus has been increasingly demand in the international market due to its spectacular inflorescence that appears from underground with diverse shape, size and color. It has been identified as significance holticultural materials and element for ecotourism. The present study is mainly to determine the diversity, occurrence, ecology and identifying economic values such as for commercial cultivation for ornamental plants of *Amorphophallus* in Sarawak and Sabah.

To date eleven species of *Amorphophallus* have been recorded during field surveys in Sarawak: *A. angulatus* Hett. & A.Vogel, *A. brachyphyllus* Hett., *A. borneensis* (Engl.) Engl. & Gehrm, *A. costatus* Hett., *A. pendulus* Bogner & Mayo, *A. eburneus* Bogner, *A. hewittii* Alderw, *A. infundibuliformis* Hett., A.Dearden & A.Vogel , *A. hottae* Bogner & Hett., *A. julaihii* Ipor, Tawan & P.C.Boyce. Of these *A. julaihii*, from the limestones of Mulu National Park, Miri (Ipor *et al.* 2004) and *A. ranchanensis* Ipor, Tawan & Simon found in recreation park of Ranchan fall in Serian were newly described species (Ipor *et al.*, 2007a) while *A. costatus* Hett., recorded from Lapuk (Miri) and from Belaga (Kapit/Bintulu borders) is a new record in Sarawak (Ipor *et al.,* 2007b).

Amorphophallus species were commonly found at forest margins, in open forest, on (steep) slopes, in disturbed parts of primary forest, secondary forest and considerably disturbed or exposed areas such as in karst limestone areas. *A. brachyphyllus* and *A. eburneus* are restricted to limestone habitats in Padawan, Bau (both in Kuching), Niah National Park and Mulu National Park (both in Miri). *Amorphophallus julaihii* is restricted to limestone hills of Mulu National Park. *Amorphophallus hottae* is also endemic to limestone habitat that has been recorded at Camp 5 of limestone pinnacle site in Mulu National Park, Miri. All the four species display a high degree of specialization to limestone.

Amorphophallus angulatus, *A. borneensis*, *A. hewittii*, *A. infundibuliformis* and *A. pendulus* are associated with mineral, sandstone and shale soils of mixed dipterocarp, kerangas, secondary and riverine forests as well as the traditional orchard areas. *Amorphophallus borneensis* is the most common and widely distributed throughout the State. Ipor *et al.* (2007c) has reported their work on ecology and response of the species to shading.

There is a paucity of information or scientific reports on the ecology, distribution patterns and taxonomic studies of *Amorphophallus* in the tropical region such as Malaysia and Indonesia. With the increasing rate of habitat destruction and disturbance due to logging, shifting cultivation, clearing for sedimentary farming, quarry activities at limestone areas, resettlement, building construction, deforestation and infrastructural development, the *Amorphophallus* species may continuously threaten to its local extinction. Illegal collections of tubers and seeds by local and foreign collectors are apparently very severe to meet the international demands of the planting materials for ornamental needs. In Sumatera, the locals collected large amounts of tubers of *A. titanum* and smuggled out to Japan and Korea. The continuous exploitation means that mature tubers lead to over collect in populations. With drastic and uncontrolled decline in the number of tubers may obviously results in significant decrease of flowering materials that are able to produce seeds that essentially determine the survivorship of the *Amorphophallus* species.

Besides herbarium collections, successful cultivation or planting with successful planting material preparation such as through tissue culture of *Amorphophallus* will determine the success of these plants to be commercially utilized as ornamental materials and perhaps the implementation of sustainable conservation of these unique endemic plants. Our greenhouse experience seems to favor the success of the complete cycle of its cultivation on condition that strict horticultural practices should be followed. Ipor *et al.* (2007c) indicated that the determination of the requirement of light for good growth performance of *A. eburneus* and *A. brachyphyllus* was essential to obtain healthy plants. Other ecophysiological studies such as effect of water stress, response to different soil types and other environmental factors are also very important. The problem of rotten tubers as a result of being infected by pathogens and infested by nematodes was the major obstacle in getting a complete cycle of *Amorphophallus* to flowering stage. Determining the sufficient amount and frequency of watering and correct selection of fertilizers are also important

factors to be familiarized. In addition, the successful conservation programme can be achieved with the establishment of suitable infrastructure in preparing and maintaining artificial *Amorphophalllus* populations. Maintaining wide coverage of plant collections would represent excellent genomic diversity.

Amorphophallus julaihii from Mulu National Park

Amorphophallus borneensis, one of the biggest *Amophophallus* species in Borneo

Amorphophallus hewittii, a limestone specialist from Bau limestone areas

Amorphophallus infundibuliformis, a Bornean endemic species

Our field experience also revealed that there was great difficulty in identifying two closely related species, *viz. A. borneensis* and *A. hewittii*. The morphological similarity of these species frequently resulted in erroneous identification of the species. The taxonomic confusion is becoming complex with the involvement of the third species, *A. lambii*. The relationship between the three species, *A. borneensis*, *A. hewittii* and *A. lambii* Mayo & Widjaja and their individual taxonomic status needs to be reviewed and comparative and systematic study that involves molecular approach is presently conducted by our postgraduate student. All of the three species, *A. borneensis*, *A. hewittii* and *A. lambii* belong to the Lambii group. Apart from that, the other species belonging to the Lambii groups are *A. plicatus* Bok & Lam, *A. tinekeae* and *A. titanum* (Becc.) Becc. ex Arcangeli. The Lambii groups is defined by: Medium to massive herbs. Tuber depressed globose, never forming offset. Inflorescence long or short peduncled; spathe more or less broadly campanulate, margins involute, rarely lobed (*A. titanum*), outside bright green, inside pale purple; spadix usually longer than spathe; appendix elongate fusiform-conical, longer than male and female zone. Styles prominent. The Lambii group are widely distributed in the West Malesia (Sumatra, Borneo, Sulawesi).

Sixteen indigenous species of *Amorphophallus* recorded in Sarawak and Sabah are so far endemic to Borneo. These species display a high degree of geological or habitat specialization. Species such as *A. eburneus*, *A. brachyphyllus, A. hottae* and *A. julaihii* are strictly confined to limestone habitat could be of great interest to investigate their genetic stability. The relationship of *A. hewittii*, *A. borneensis* and *A. lambii* should be thoroughly investigated to further understanding their taxonomic status. The high degree of morphological similarities of the wide distribution from various habitats would be interesting to investigate in detail. It is strongly predicted that a number of novelties from both Sarawak and Sabah are awaiting to be described as new in science.

Acknowledgements

We would like to thank UNIMAS for the financial support under research grant 01(45)/325/2002(62) and Ministry of Higher Education Malaysia under FRGS grant No. FRGS/01(02)/607/2006(40) and FRGS/06 (13)/678/2008(11). Appreciation is also extended to Salim Arip, Samsudin Amin, James Abai, Sekudan Tedong, Mohd. Rizan Abdullah and Norhasmah Suip.

References

Ipor, I.B., Garon, J.B., Tawan. C.S. and Meekiong, K. (2007a). Ecology of *Amorphophallus eburneus* (Bogn.). endemic plant of Sarawak, Malaysia. *The Sarawak Meseum Journal* 84: 181-203.

Ipor, I.B., Tawan, C.S. and Boyce, P.C. (2004). A new species of *Amorphophallus* (Araceae: Thomsonieae) from Sarawak. *Gardens' Bulletin Singapore* 56: 153-159.

Ipor, I.B., Tawan, C.S., Simon, A., Meekiong, K., and Fuad, A. (2007b). A new species of *Amorphophallus* (Araceae: Thomsonieae) from Sarawak. *Folia Malaysiana* 8(1): 110.

Ipor, I.B., Tawan, C.S., Zaini, R., Singka, R.C., Simon, A. and Sidi, M. (2007c). Ecology and response of *Amorphophallus borneensis* (Engl.) Engl. & Gehrm. to shading. *Malaysian Applied Biology Journal* 35(1): 15-26.

Polychaetes in Santubong Beach, Sarawak

Diana Abd Rasani and Shabdin Mohd Long
Department of Aquatic Science

Various types of polychaete can be found on shallow sandy, muddy bottoms of the intertidal mudflat (Edward *et al.*, 1992). Polychaetes can be easily recognized as segmented worms with many legs that called parapodia. It also known as lugworms, clam worms, bristle worms, fire worms, palolo worms, sea mice, and feather duster worms. It belongs to Phylum Annelids and there are about 9000 species of polychaetes are currently recognized. They have segmented or metameric body which is the key characteristic that differentiate them with other phylum. They are classified into two groups (Errantia and Sedentaria) based on their mode of living (Arnold, 1987) and development of the anterior end (Fauchald, 1977). Errant polychaetes move freely through the sediment while sedentaria polychaetes live in interstitial spaces in burrows or tubes (Meksumpun and Meksumpun, 1998).

Polychaetes play an important role in the marine open food web and they have commercial value and have potential in aquaculture industry (Olive, 1999). For example, there are some species called 'kompon' or scientifically known as *Diopatra* sp. have been use as bait by the local fisherman in Sarawak (Fig. 1). *Nereis* spp. and *Arenicola marina* has been use as bait by anglers in British coast and also *Perinereis aibuhitensis* and *Glycera dibranchiate* has been use in Portugal (Pedro *et al.*, 2006). Furthermore, this species is also commercially important and their production has been increased because the use of polychaete as a live feed food source is now well established in the aquaculture of penaeid crustacea and finfish. Some other species like *Nereis viviens* are major components of the diet of many commercial demersal fish (Pantelis *et al.*, 2004). Polychaete are also useful for treating organic polluted sediment under fish net culture because Capitellids has the potential in promoting organic matter decomposition and sulfide oxidation in sediments (Meksumpun and Meksumpun, 1998). Moreover, they can be a good bioindicator for coastal waters pollutions since population, urbanization and industrialization are rapidly growing in Sarawak.

A study have been performed to obtain the preliminary data on the horizontal distribution pattern of polycheates from high to low tide area and the influence of the physico-chemical parameters on the density of polychaetes in the intertidal area of

Fig. 1: Head taken; Use as bait by the local fisherman

Santubong beach. Three horizontal line transects have been placed perpendicular to the beach from high to low tide area and marked as a station in every 50 m. In each station, *in-situ* measurements of physico-chemical parameters such as salinity, temperature, pH, and dissolved oxygen were obtained. Sediments were sieved by using 0.5 mm sieve before preserved in 10% formalin in a labeled specimen bottles and the number of polychaete individual presence in each station was enumerated (Fig. 2).

Fig. 2: Sediments were seived using 0.5 mm seive

The result indicates that the highest mean number of polychaetes density (Fig. 3) was recorded from line two which is 214.98 individuals/m^2 followed by 108.2 individuals/m^2 from line three and 105.36 individuals/m^2 from line one. The pattern of the polychaetes distribution is not evenly distributed from low tide to high tide level. Physico-chemical parameters result indicates that the mean of the temperature in line one

was 27 °C, salinity 33 PSU, pH 7.6, and dissolved oxygen 9.3 mg/l. While the mean of the temperature in line two was 25 °C, salinity 21 PSU, pH 7.6, and dissolved oxygen 8.7 mg/l and the mean of the temperature in line three was 25 °C, salinity 30 PSU, pH 8.8, and dissolved oxygen 4.9 mg/l. Pearson correlation coefficient shows that the polychaetes density is found to have a correlation with the temperature, salinity, dissolved oxygen and pH. This finding shows that Santubong intertidal area has an abundance of polychaetes assemblage.

Fig. 3: Some of the polychaetes collected; Glyceridae, Oweniidae and Maldanidae

In the future, data on the species found along the Sarawak coastal water will be recorded and a pictorial key for polychaetes identification up to species level will be produced since many species are identified up to genus level only. Futhermore, several polychaete species will be selected from the database for future study in culturing the polychaetes as an alternative diet in the aquaculture industry.

References

Arnold, P.W. (1987). *Polychaeta in soft sediment marine invertebrates of Southeast Asia and Australia: A guide to identification.* In English, S. A. (Ed.) Course notes from a workshop held at James Cook University, Townsville, Australia. Pp 82-116.

Edward, F.R., Calvin, J., Phillips, D.W. and Hedgpethet, J.W. (1992). *Between Pacific Tides,* Fifth Edition. Stanford University Press, United States. Pp 523.

Fauchald K. (1977). *The polychaete worms. Definitions and keys to the orders, families and genera.* Natural History Museum of Los Angeles County, Science Series 28.

Meksumpun, C. and Meksumpun, S. (1998). Polychaete-sediment relations in Rayong, Thailand. *Environmental pollution* 1: 447-456.

Olive, P.J.W. (1999). Polychaete aquaculture and polychaete science: a mutual synergism. *Hydrobiologia* 402: 175-183.

Pantelis, K., Smullena, R.P. and Ingliset, V. (2004). The use of the polychaete worm *Nereis virens* eggs as vehicle for the delivery of oxytetracycline in *Solea solea* larvae. *Aquaculture* 243: 1-7.

Pedro, F.E.C., Gil, J., Passos, A.M., Pereira, P., Melo, P., Batista, F. and Da Fonseca, L.C. (2006). The market features of imported non-indigenous polychaetes in Portugal and consequent ecological concerns. *Scientia Marina* 70: 287-292.

Potential geosmin and 2-methylisoborneol producing cyanobacteria and actinomycetes in selected aquaculture ponds and water supply system

Nurhartini Kamalia Yahya and Ruhana Hassan
Department of Aquatic Science

Malaysia has been actively involved in the aquaculture industry for decades and produces about 230 thousand metric ton of fish just for the year 2007 (Department of Fishery, 2008). Aquaculture industry plays a major role on Malaysian economic growth and positively supports a better socio-economic development for the coastal communities. However, one of the aquaculturally-related problems namely 'off -flavour' of fishes remains unreported although this problem has been acknowledged world-wide. The 'off-flavour' of fishes is caused by tertiary alcohols known as geosmin and 2-methylisoborneol (2-MIB) (Juttner and Watson, 2007). These compounds are known to be produced by planktonic and benthic algae particularly cyanobacteria, fungi, bacteria and actinomycetes (Izaguirre *et al.*, 1982). The compounds are both semi-volatile and could be easily detected by the human nose even at the concentration of less than 0.004-0.02 µg/l in water (Lloyd *et al.*, 1998). Geosmin and 2-MIB that exists in (+) and (-) enantiomers both possess a unique earthy or musty or muddy odour which could be easily recognized anywhere. The problem of 'off-flavour' in fishes arises when the (-) form of these two lipophilic compounds bioaccumulates in the lipid rich fish tissues causing off-flavour to occur (Robertson *et al.*, 2006). Besides that, the occurrence of geosmin and 2-MIB in water supply systems also reduces the water quality in areas where surface water is used for drinking water (Klausen *et al.*, 2005). Therefore, this study is designed to (i) assess the cyanobacteria and actinomycete diversity that potentially produces the compounds in selected Malaysian aquaculture ponds and water supply system, (ii) determine the level of geosmin and 2-MIB pollution, and (iii) develop a rapid and accurate detection method using molecular approach for sources of geosmin and 2-MIB originating from cyanobacteria and actinomycetes.

Monocultures of *Anabaena* spp. which is one of the cyanobacteria that potentially produces geosmin and 2-MIB are now in our culture collection (Fig. 1), hence the experiments are now positively progressing to objective (ii) and (iii). More water samples comprising of cyanobacteria and actinomycetes will be collected from other aquaculture ponds and water supply systems, which will later be subjected to single cell

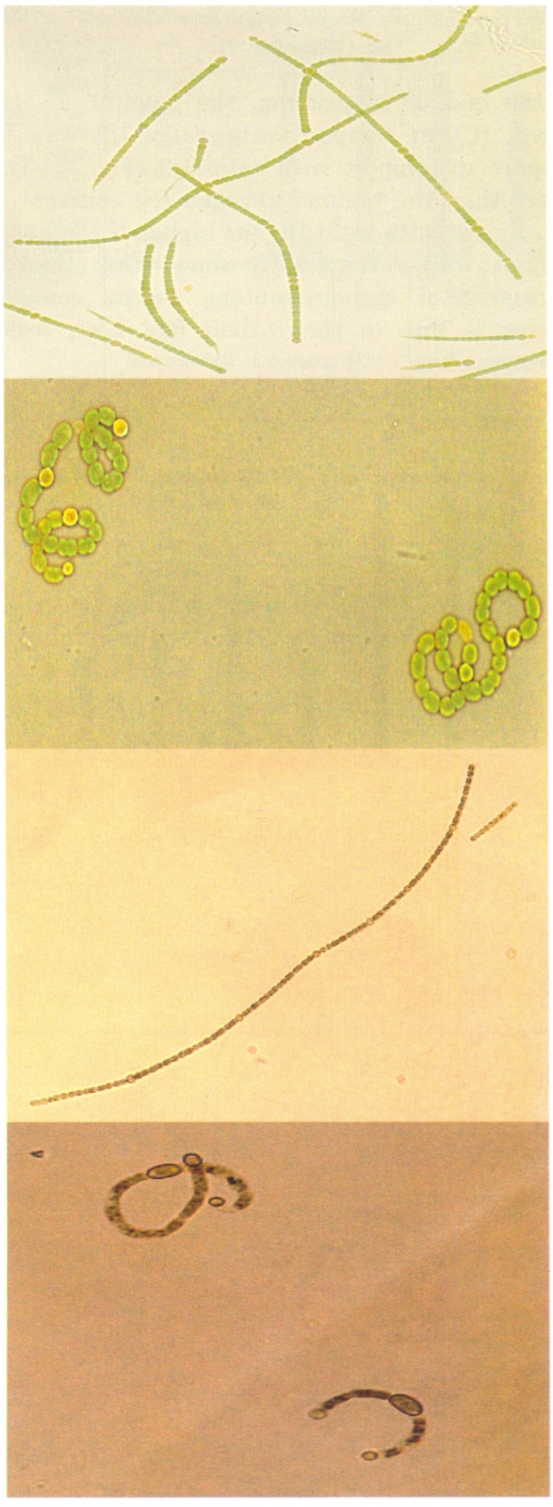

Fig. 1: *Anabaena* spp. in Aquatic Science Department's culture collections. Note the different morphological features-straight trichomes and coiled. Their ability to produce geosmin and 2-MIB pollution is still under investigation.

isolation followed by the development of axenic clonal cultures. Later, the assessment of the level of pollution will be carried out using Gas Chromatography-Mass Spectrometry (GC-MS) as well as exploration of the rapid detection method using molecular approach. Upon completion of this project, the data will shed some lights on fishes 'off-flavour' problems in Malaysia.

References

Department of Fishery, Malaysia (2007). *Estimated value and aquaculture production from all aquaculture system, 1998-2007.* Retrieved October 8, 2009 from http://www.dof.gov.my/web.html

Izaguirre, G., Hwang, C.J., Krasner, S.W. and McGuire, M.J. (1982). Geosmin and 2-methylisoborneol from cyanobacteria in three water supply systems. *Applied and Environmental Microbiology* 43(3): 708-714.

Juttner, F. and Watson, S.B. (2007). Biochemical and ecological control of geosmin and 2-methylisoborneol in source waters. *Applied and Environmental Microbiology* 73(14): 4395-4406.

Klausen, C., Nicolaisen, M.H., Strobel, B.W., Warnecke, F., Nielsen, J.L. and Jorgensen, N.O.G. (2005). Abundance of actinobacteria and production of geosmin and 2-methylisoborneol in Danish streams and fish ponds. *FEMS Microbiology Ecology* 52: 265-278.

Lloyd, S.W., Lea, J. M., Zimba, P.V. and Grimm, C.C. (1998). Rapid analysis of geosmin and 2-methylisoborneol in water using solid phase micro extraction procedures. *Water Research* 32: 2140-2146.

Robertson, R.F., Hammond, A., Jauncey, K., Beveridge, M.C.M. and Lawton, L.A. (2006). An investigation into the occurrence of geosmin responsible for earthy-musty taints in UK farmed rainbow trout, *Onchorhynchus mykiss*. *Aquaculture* 259: 153-163.

Preparation of compost from palm oil empty fruit bunches

Rafeah Wahi and Izzatul Adilah Yusup

Department of Chemistry

Malaysia had become one of the countries that produce large number of palm oil. According to Malaysia's Ministry of Plantation Industries and Comodities and Ministry of Finance, in 2007 alone 4,278,000 hectares had been planted with palm oil. Oil palm empty fruit bunch (EFB) is the most abundant wastes which being produce after the oil palm fresh fruit bunch (FFB) being processed for palm oil production (Fig. 1). It was reported that about 8.1 million tons of EFB are produced every year (Suhaimi and Ong, 2001).

Compost was prepared in a composting bin with dimension of 45.5 cm x 31.0 cm x 25.0 cm and perforated walls to enable aeration. Grinded EFB and wood chips of particle sizes 5-20 mm were mixed at wood chips: EFB ratios of 1:2 and 1:3 (w/w) before

Fig. 1: EFB from palm oil processing plant

placed in the composting bin and sprinkled with water and stirred every 48 h to allow optimum microbial activities in compost. After a month, compost sample (referred to as early stage compost) was taken for chemical analysis before 500 g of chicken manure was added to the compost and mixed homogenously (intermediate stage compost) to enhance the composting rate. After 2 months, the compost mixture (final stage compost) was analyzed.

Chemical characteristics of the EFB composts are summarized in Table 1. Results shows that the ash content of the early, intermediate and final stage composts continually increased as the composting time increased. The changes of the ash reflect actual trend in the mineralization of organic matter in the composts (Aparna *et al.*, 2008). Compost with the wood chips: EFB ratio of 1:2 gives higher ash content and combustible content compared to the compost with ratio 1:3. The mineralization index after 2 months composting are 32.44% and 31.57% for compost with wood chips:EFB ratio 1:2 and 1:3 respectively.

At the end of composting, the amount of organic carbon (C) in compost with ratio 1:2 was lower compare to compost with ratio 1:3 (Fig. 2). This is differs than the organic nitrogen (N) content where the compost with ratio 1:2 has higher N content than compost with ratio 1:3. It shows that there was decreasing of carbon content during composting process is due to the carbon had been used by microorganism.

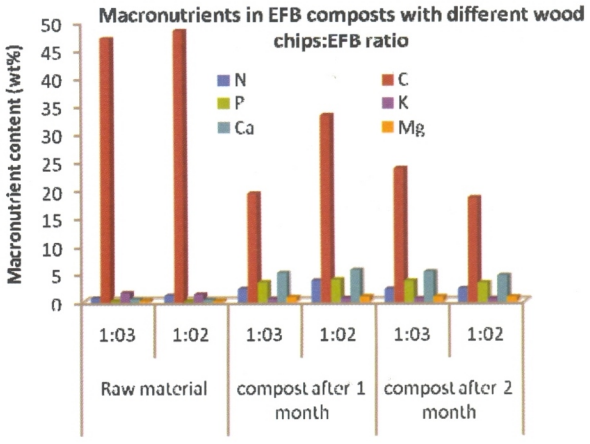

Fig. 2: Macronutrients in EFB composts with different wood chips: EFB ratio

N, P, K, Ca and Mg are essential macronutrient of plants and are highly needed for plant metabolism. In the studied composts, the macronutrient is increasing from the early of composting until the end of composting. At the final stage of composting, it showed that compost with wood chips:EFB ratio of 1:3 has higher macronutrient compared to the compost with ratio of 1:2. Essential micronutrients such as Zn, Mn, Ni, Cu and B are found higher in compost with wood chips:EFB ratio of 1:3 compared to the compost with ratio of 1:2 (Fig.3).

Table 1: Proximate analysis of empty fruit bunches (EFB) compost

Analysis	Raw material		Compost after 1 month		Compost after 2 month	
	1:3	1:2	1:3	1:2	1:3	1:2
Moisture-dry basis (wt%)	9.95	11.24	12.58	13.55	12.58	12.67
Ash (wt%)	49.21	50.21	70.67	64.23	71.91	75.07
Combustibles (wt%)	40.85	38.56	16.74	22.33	15.52	12.23

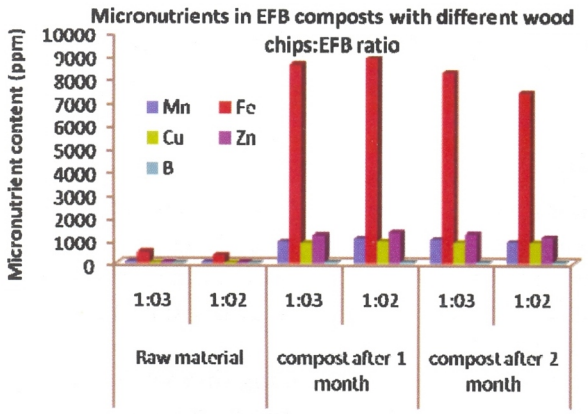

Fig. 3: Micronutrients in EFB composts with different wood chips: EFB ratio

Future work on EFB compost includes the determination functional groups in the composts, toxicity study and studies on the effect of the EFB compost on the growth of selected vegetables.

References

Aparna, C., Saritha, P., Himabindu, V. and Anjaneyulu, Y. (2008). Techniques for evaluation of maturity for composts of industrially contaminated lake sediments. *Waste Management* 28(10): 1773-1784.

Suhaimi, M. and Ong, H.K. (2001). *Composting empty fruit bunches of oil palm.* The Food and Fertilizer Technology Center. Retrieved 1st November 2001 from http://www.agnet.org/library/eb/505a/

Recent event update

The second harmful algal blooms and biotoxins workshop 21-24th Dec 2009

The second Harmful Algal Blooms (HABs) and Biotoxins National Workshop with the theme: "*Morphological and molecular characterization of HABs species in Malaysian waters*" was held on the 21st till 24th December 2009 at the Faculty of Resource Science and Technology, UNIMAS. The workshop was jointly organized by Universiti Malaysia Sarawak, Human Capital Development (HCD) and National Oceanography Directorate (NOD), Ministry of Science, Technology and Innovation (MOSTI).

The workshop drew over 35 participants, including representatives from government agencies, research institutes as well as postgraduate students and researchers from other national universities. A series of lectures was delivered in the four-day workshop by the invited speakers, Prof. Gires Usup (UKM), Dr. Leaw Chui Pin (IBEC, UNIMAS) and Dr Lim Po Teen (FRST, UNIMAS), with emphasis on different group of phytoplankton species that responsible for HABs events in Malaysia waters. In the workshop, participants were also given hand-on training on basic and advanced techniques in HABs monitoring and researches during the practical sessions. This included the advanced epi-fluorescence, scanning and transmission electron microscopy techniques, and rapid molecular detection of HABs species. The workshop also included active discussion regarding issues related to current status and future research of HABs in Malaysia. As a result of the workshop, participants were well equipped in handling HABs issues, which achieved it objective in enhancing the capacity of researchers from different agencies in dealing with prevailing HABs events in the country.

The second harmful algal blooms and biotoxins workshop organizing committee and participants